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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 10/044,624 | 01/08/2002 | Jon Coker | CH920000088US1 | 8594 |
| 7590 | 07/14/2004 | | EXAMINER | |
| IBM Corporation Intellectual Property Law 5600 Cottle Road (L2PA/0142) San Jose, CA 95193 | | | CHASE, SHELLY A | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2133 | |

DATE MAILED: 07/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|-----------------|---|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/044,624 | COKER ET AL.  |
| | Examiner | Art Unit |
| | Shelly A Chase | 2133 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 08 January 2002.

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-9 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-9 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.

 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a))

* See the attached detailed Office action for a list of the certified copies not received.

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Attachment(s)

1) Notice of References Cited (PTO-892)
2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
4) Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) Notice of Informal Patent Application (PTO-152)
6) Other: _____.

DETAILED ACTION

1. Claims 1 to 9 are presented for examination.

Priority

2. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Switzerland on 08 January 2001. It is noted, however, that applicant has not filed a certified copy of the 01100445.4 application as required by 35 U.S.C. 119(b).

Claim Objections

3. Claims 1, 4, 6 and 8 are objected to because of the following informalities: claim 1, please change "the absolute value" to --- an absolute value ---- recited on line 11 and change "the previous metric" to --- a previous metric --- recited on line 13. Claims 4, 6 and 8 have a similar problem.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
5. Claims 1 to 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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Claim 1, recites the limitation "the ratio of logarithmic probabilities" recited on line 9.

There is insufficient antecedent basis for this limitation in the claim. The examiner is unsure if the phrase refers to the log likelihood ratios or another element. Claims 2 to 3 are also rejected due to their dependency on a rejected base claim.

Claims 4, 6, and 8 are rejected under 112 second paragraph due to a similar problem.

Allowable Subject Matter

6. Claims 1 to 9 would be allowable once the 112 second paragraph rejection is overcome.
7. The following is a statement of reasons for the indication of allowable subject matter: the instant invention recites a method and an apparatus for decoding low density parity check (LDPC) codes utilizing a sum-product algorithm to recover a set of information bits from the LDPC express as a bipartite graph of symbol nodes and check nodes wherein the updating of the check nodes comprises generating a forward difference metric and backward difference metric.

The prior art made of record teaches decoding LDPC utilizing a sum-product algorithm wherein the check nodes are updated. For instance, Kschischang et al. (*Factor graphs and the sum-product algorithm*), discloses a forward back algorithm with a sum-product algorithm wherein a forward $[\alpha]$ function is computed and backward $[\beta]$ function is computed for a received input variable and $[\alpha]$ and β computed functions are used in the sum-product update computation. Chung et al. (*Analysis of sum-product decoding of low density parity check codes using a Gaussian approximation*), discloses

decoding LDPC codes with a sum-product algorithm wherein a log likelihood ratio (LLR) is used in the sum-product calculation and for the check node update and Mao et al. (*Decoding low density parity check codes with probabilistic schedule*), discloses decoding LDPC codes expressed as a Tanner graph (TG) of symbol nodes and check nodes wherein the sum-product algorithm is used in the updating rule based on the frequency and the length of the shortest cycle.

However, the prior art made of record, taken alone or in combination, fails to teach or fairly suggests or render obvious the novel element of the instant invention of updating each metric in the set of forward difference metric or backward difference metric in dependence on the absolute value of the log likelihood ratios associated with the symbol nodes recited in independent claims 1, 4, 6 and 8. Specifically, the prior art made of record fails to teach or fairly suggests a method for decoding low density parity check codes, the method comprising: updating each metric in the set of forward difference metric in dependence on an absolute value of the log likelihood ratio associated with the symbol node and an absolute value of a previous metric in the set, updating each metric in the set of backward difference metrics in dependence on an absolute value of the log likelihood ratio associated with the symbol node and an absolute value of a previous metric in the set.

Claims 2 to 3 are directly dependent on claim 1 thus; these claims are allowable over the prior art made of record. Claims 4, 6 and 8 include the allowable subject as recited in claim 1 thus, these claims are allowed for the same rationale applied to claim 1.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelly A Chase whose telephone number is 703-308-7246. The examiner can normally be reached on Mon-Thur from 8:00 am to 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decay can be reached on 703-305-9595. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Shelly A Chase